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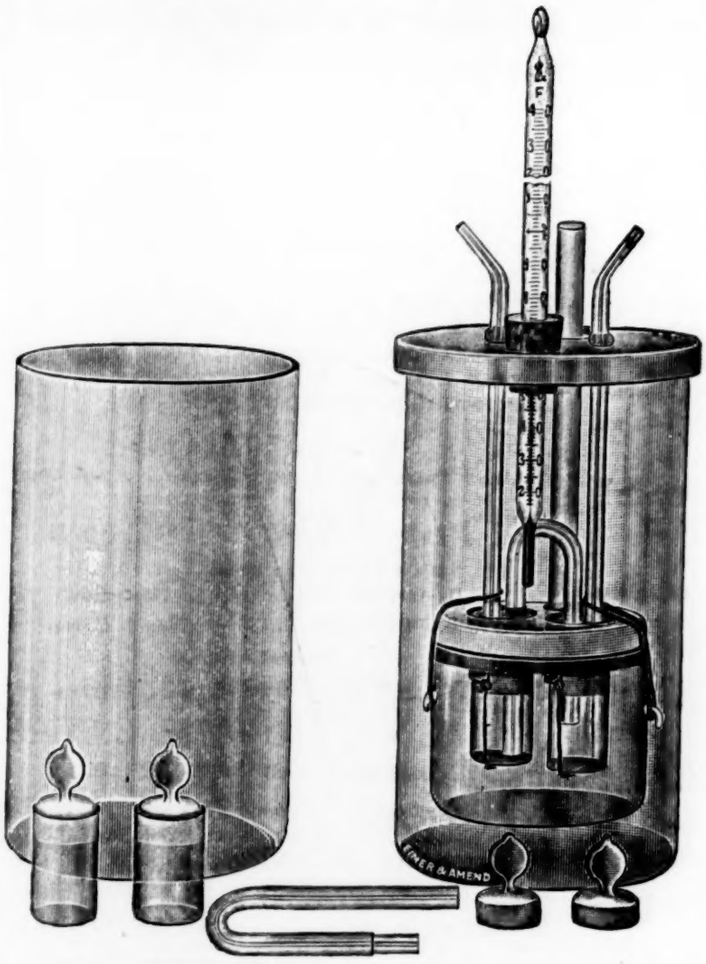

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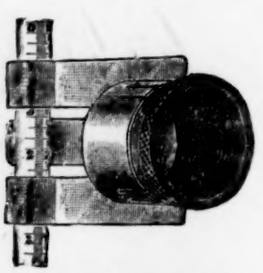

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THE RESPONSIBILITIES OF THE SCIENTIST[1]

LITTLE more than two years ago, the American man of science was in his laboratory, busy with the problems of research. The possibilities of progress were never greater, and the obligation to exceptional effort, for the purpose of assisting to retrieve some of the heavy losses suffered by science through the war, was constantly before him. But the perennial attractions of research and the strongest desire to advance science were insufficient to hold his attention. He watched with indignation the piratical attacks of the submarine, the brutal invasion of provinces and states, the unspeakable horrors of the German advance. Undeceived by specious pleas for peace, he recognized the clear duty of the United States, and chafed at repeated delays when quick and determined action would have saved countless lives. And when, at last, we entered the war, he eagerly grasped any opportunity for service that came to him. Sometimes the opportunity did not come, and he then accepted the more difficult, but no less obvious, duty to persevere in his researches and thus to preserve the continuity of scientific progress.

The experience during the war of the man of science has sometimes been confusing, and it is possible that his responsibilities on the return of peace will not always be clearly recognized. Men who have previously devoted their lives to the advancement of knowledge have suddenly been called upon to solve practical problems, of the greatest military or industrial importance. In attacking these new questions, they have shown remarkable powers of adaptation, and surprise has often been

[1] Read before the Pacific Division of the American Association for the Advancement of Science, as a part of a symposium on "Scientific Education in a Democracy."

expressed that they could turn so readily from fundamental researches for the increase of knowledge to the most intensely practical undertakings.

But a moment's consideration will show how easily the change has been effected. An eminent physicist develops a new range-finder, which is adopted by the navy because of its superiority to any existing instrument. But what could be less surprising, in view of his life-long success in devising new optical instruments for physical research?

Several men of science, working in close cooperation, effect great improvements in a device for accurately locating invisible submarines, even when completely at rest and emitting no sound. But the fundamental principles and methods involved in this war research are precisely the same that these investigators have employed for years in their electrical and astronomical investigations. And so I might go on, mentioning scores of important war services performed by physicists, mathematicians, chemists, astronomers, meteorologists, geologists, botanists, zoologists, bacteriologists, anthropologists, psychologists and investigators dealing with every branch of science, whose previous efforts have been wholly devoted to the advancement of knowledge.

Some of these men, when seriously reflecting upon their responsibilities at the close of the war, have hesitated to return to their old tasks. They have often been applauded, by those who know nothing of research, for their newly-discovered ability to accomplish "practical" results, and to contribute in this obvious way to the public welfare. Or they have been offered by the industries salaries far in excess of those they receive from the university or technical school. Which way shall they turn? How may they best serve the world?

These questions have been clearly answered long since, not only by students of science, but no less emphatically by great leaders of industry. No American engineer stands higher than J. J. Carty, vice-president of the American Telephone and Telegraph Company, recently colonel in the Signal Corps, in charge of our lines of communication in Europe. In his address as president of the American Institute of Electrical Engineers, after showing that the industries, through self-interest, will provide amply for industrial research, Colonel Carty dwells on the importance of fundamental researches in science, and remarks:

> By every means in our power, therefore, let us show our appreciation of pure science and let us forward the work of the pure scientists, for they are the advance guard of civilization. They point the way which we must follow. Let us arouse the people of our country to the wonderful possibilities of scientific discovery and to the responsibility to support it which rests upon them, and I am sure they will respond generously and effectively.

Or take the word of W. R. Whitney, director of the great industrial laboratory of the General Electric Company:

> Necessity is not the mother of invention; knowledge and experiment are its parents. This is clearly seen in the case of many industrial discoveries; high-speed cutting tools were not a necessity which preceded, but an application which followed, the discovery of the properties of tungsten-chromium-iron alloys; so, too, the use of titanium in arc lamps and of vanadium in steel were sequels to the industrial preparation of these metals, and not discoveries made by sheer force of necessity.

Or remember the statement of Huxley:

> I weigh my words when I say that if the nation could purchase a potential Watt, or Davy, or Faraday, at the cost of a hundred thousand pounds down, he would be dirt-cheap at the money. It is a mere commonplace and everyday piece of knowledge that what these men did has produced untold millions of wealth, in the narrowest economical sense of the word.

How true this is, how directly the greatest practical advances are dependent upon researches made solely for the advancement of knowledge, without any thought of immediate application, is well illustrated in the case of wireless telegraphy. The existence of waves in the ether, much longer than those that give the impression of light, but traveling with the same velocity, was first definitely shown by Maxwell, in his purely mathematical investigations on the electromagnetic theory of light. For twenty years these waves were known only in his equations, but in 1888 Hertz found

that they were actually emitted by a spark in his laboratory, and could easily be detected across the room and at greater distances. This made wireless telegraphy possible. Afterwards it was only a question of perfecting the transmitting and receiving devices in order to increase their range. This was no light task, and we owe much to Marconi and others for accomplishing it. But it is plain that wireless telegraphy could not have been even imagined before the discovery of electric waves in the ether by Maxwell and Hertz.

Some advances in science are less direct in their application, but even more significant. Of what benefit to the world is astronomy, the oldest of the sciences? I need not dwell on its obvious applications in the measurement of time, in accurate surveys of the earth's surface, in the determination of positions at sea. These uses render astronomy invaluable, but they do not represent its greatest contribution to the world.

To appreciate this, we must turn to the pages of Henri Poincaré, in his little book on "The Value of Science." The basis of scientific progress is law, and we owe the conquest of law to astronomy. Where would our modern civilization be, asks Poincaré, if the earth, like Jupiter, had always been enveloped by clouds? Our remote ancestors were creatures of superstition, surrounded by mysteries, startled at every display of incomprehensible forces, accustomed to attribute all natural phenomena to the caprice of good and evil spirits. To-day we no longer implore the aid of nature: we command her to do our bidding, because we have learned some of her secrets, and are constantly solving others. We command her in the name of laws which she can not repudiate, because they are her own. Recognizing, as we do, the unchangeable basis of these laws, we do not foolishly demand that they be changed, but submit ourselves to them, and utilize them to the advantage of mankind.

Astronomy taught us the existence of the laws of nature. The Chaldeans, first to observe the heavens attentively, perceived harmony of motion and sequence of phenomena. Day and night, the round of the seasons, the phases of the moon, the periodic wanderings of the planets, held their attention and encouraged their study. Their work was continued by the Greek astronomers, who discovered rule after rule with the simple instruments at their command. Tycho Brahe, Copernicus, Kepler and Galileo pushed forward the advance at an accelerating rate, until Newton finally announced the oldest, the most accurate, the simplest and the most general of all natural laws.

Encouraged by these never-ending successes, students turned their attention to the phenomena of the earth's surface, and found in their apparent disorder the same harmony and the same reign of law. But the infinite variety of nature, the conflict of forces, and the extreme complexity of terrestrial phenomena would have greatly delayed progress if the simple and easily-discovered rules of the heavens had not pointed the way. Faced with discouragement, the physicist or the zoologist could fall back upon the assurance, which astronomy had repeatedly afforded, that nature does obey laws. Their task, therefore, was to discover these laws, and to persist in their endeavors until the difficulties had been overcome.

I wish that time permitted me to follow Poincaré further and to show how the world's debt to astronomy rests not merely upon her initial discovery of natural laws, but also upon her proof that these laws, once accurately determined, are unchangeable through the centuries, and that they apply in every part of the visible universe. I might also show how Copernicus and Galileo, when they demonstrated that the sun and not the earth is at the center of our system, smashed into fragments the medieval mode of thought, and reestablished the true methods of science, previously used in more restricted form by the Greeks. If it were still maintained that the task of astronomy has been accomplished, I might point out that only yesterday it demonstrated that the elements and some of the compounds of the chemist are not confined to the earth, but are present in the most distant stars, and that the latest developments of electrical theory and the most recent investigations on the nature of matter are tested by

observations of the sun, stars, and nebulæ. And I might add, if I thought it would strengthen the argument, that the light gas helium, which was first produced on a large scale during the war, and would have rendered the great bombing dirigibles of the Allies practically safe over Berlin, because of its non-inflammable and non-explosive character, was discovered in the sun a quarter of a century before it was found on the earth.

But I have said enough, I hope, to convince you that astronomy has been of real service to the world, and that its study should be continued, especially in this prolific period when our understanding of the extent and nature of the universe is advancing more rapidly than ever before. And if the present duty of the astronomer to advance the knowledge of his science is plain, that of the investigator in every other field is equally so. He should go back to research, with new vigor and redoubled energy, without troubling himself for a moment with the question of immediate practical return.

Industrial research must be enormously developed in the United States, and the old distinction between pure and applied science must be swept away.[2] But once awakened, as they already are, the industries may be trusted to follow the example of the duPont Company, which began with five research chemists in 1902, and spent three millions in their research laboratories during 1918. The task of the educational institution and of the private research foundation under such conditions is a tremendous one. They must not only develop investigators capable of doing the work of the industries, as the German universities have done for so many years; they must also push forward, on a far greater scale than ever before, their researches for the advancement of knowledge. Only thus can the highest advantage of science and industry, the chief interests of public welfare, and the greatest national progress, be attained.

George Ellery Hale

Mount Wilson Observatory

[2] See Hale, "The National Engineering Societies and the National Research Council."

THE PRESS AS AN INTERMEDIARY BETWEEN THE INVESTIGATOR AND THE PUBLIC[1]

It is with some diffidence that as a rank amateur I accept the invitation of so learned a body to make any suggestions even upon that branch of your work upon which we are all amateurs. But perhaps just because it is a question, not of the discovery of truth, but of the promulgation of that truth to the unprofessional public, there may be some advantage in approaching it from the standpoint of a mere member of that public.

I am not sure that there is unanimous or immediate consent to the doctrine that any merely popular intermediary between the investigator and the public is even desirable. Certainly there has in the past been enough of aloofness on both sides, for which neither side has been guiltless. Even where science has not inherited the jealous exclusiveness of a professional guild, the original investigator had had temptation enough to remain aloof from the public. If his discoveries were of any practical use, others would advertise them soon enough. If they merely opened wider the portals of truth, the public was little interested, and there would be time enough for its enlightenment when the ponderous monograph became a sentence or a footnote in the elementary text-books. Besides, it seemed so hopeless to give the public what it ought to have, and so worse than useless to give it what it wanted. The whole mental viewpoints were different. The scientist is cautious, accurate and impersonal. He uses his imagination, not to jump at conclusions, but as a guide to experiment and investigation. He hesitates to announce a discovery until he has fully verified it, and then he limits himself strictly to the one step he has taken into the Unknown, and avoids flights of fancy into its speculative possibilities. If his knowledge is fragmentary, he refuses to fill out its gaps, and he is resolutely non-committal on what he does not know. He cultivates an imper-

[1] Read before the Pasadena Division of the American Association for the Advancement of Science, June 20, 1919.

sonal impartiality, and even on a controverted question he would scorn to win a victory over an opponent by misstating or understating that opponent's position or evading any of the evidence for it. The public, on the other hand, demands cocksureness, especially on all the consequences which a discovery suggests to the imagination. It is intensely personal, and inquires first what use it can make of the discovery, or whether it confirms or opposes its prejudices. It undervalues accuracy, overvalues vivid picturesqueness, and does not understand impersonality or impartiality at all. It jumps at conclusions, and refuses to take "I don't know" for an answer. How shall the scientific man condescend to such a rabble without losing his soul?

The public, on its side, is as little ready to appreciate the scientist. Personally, it regards him as a freak. If he happen to have the personality that would be valuable to a business man—an impressive presence, an aggressive, decisive manner and the executive temperament which decides everything instantly and positively and sees that it is done—he may be respected for these qualities. But if, as is usually the case, he is not chiefly notable for these qualities, he is regarded as an "impractical dreamer," who may, by some hocus pocus, produce miracles from his magic box, but is personally entitled to no consideration. Then there is the persistent illusion of "book larnin'." Because most of the elementary education with which the public is familiar is derived from books, it is assumed that higher learning is also derived from books, and that a "professor" is merely a man who has stuffed his brain with many books. The books themselves are taken as ultimate facts, and the question, Who wrote the books? or, Where did he find out the things in them? never occurs to the mind. Even the great classics of science, like the "Origin of Species," are conceived after the analogy of the classics of theology, and Darwin may be assumed to have propounded his alleged dogma that "man descended from the monkey" much as Calvin propounded predestination or Wesley the direct conviction of salvation. And if there come rumors that some one—de Vries, for instance—has "disproved Darwinism," it is at once assumed that he is merely the leader of a new sect with a different creed. As to the strange jargon in which scientists are wont to express themselves, that is merely funny. Anyhow, scientists are a rather contemptible tribe. For if there is anything more contemptible than not knowing the particular thing I know, it is knowing something else that I do not know. It is by this compensatory contempt for the knowledge of others that we retain our self-respect in the face of our ignorance.

And I may suggest that the breaking down even of this merely personal barrier between the scientist and the layman is of immense importance to our American democracy. For our most grievous lack, as a people, is our ignoring of experts, and our fiction that "any man is fit for any job." The one German lesson which we must not permit the war to unteach us, but which it must rather emphasize a thousand fold, is the lesson of valuing and trusting the expert. It was by the misuse of the efficiency which this lesson taught her that Germany was able to stand off the world for four years, and nearly succeeded in destroying the civilization which her science had helped upbuild. If we should jump at the mad conclusion that the things which proved dangerous in the hands of autocracy for the destruction of civilization shall therefore not be used by democracy for its upbuilding, we might inflict on the world an even greater damage than that wrought by German arms. It is therefore the duty of the American expert, even at the cost of some repugnant self-exploitation, to make himself personally respected by the democracy. And he can not do that in his laboratory and through the scientific journals alone.

For any large-scale contact with the general public, the popular press is indispensable. This press may be divided into three groups—the daily newspapers the Sunday newspapers and the popular magazines.

By far the most efficient organ of publicity is the daily newspaper. Everybody reads the

newspaper every day, and most people read nothing else. Therefore, whatever of scientific truth or of the scientific spirit you can get into the daily newspaper will reach farther than it can do in any other way. But it is necessary to realize the narrow scope and the fixed perspective of the newspaper. The daily newspaper deals in just one thing—in news. If you see anything else in the paper, you may be sure that it got there under protest, as a regretted necessary evil. What is news may not be easy to define, but we may indicate it negatively by pointing out what it is not. In the first place, things are not printed as news because they are useful or useless, beneficial or injurious. You can not get anything into the paper by proving that it would be beneficial or useful, nor keep anything out by proving that it might be useless or injurious. Also, the eternal verities are not news, though a temporary and adventitious fact regarding them may be. And a thing which is news here to-day is quite likely not to be news to-morrow and elsewhere. The space and time element absolutely dominate the news. In fact, that may be made a handy negative test of news. The surest way to know that something ought to be printed in to-day's paper is to show that it would be absolutely unthinkable to print it in yesterday's or tomorrow's paper. And the news must be so attached to a particular place and person that it would be ridiculous to attach it to any other place or person, or to omit the place and personal element. If you can write a scientific truth so that the principal statement of it shall be in the first sentence, and the most important words in that sentence are "here," and "to-day," and your own name, and especially if you can so write it that it would be absurd to date it at any other place, on any other day, or with any other name, then you can probably get it into the newspaper. And after you have accomplished that one sentence, which makes it news, it is astonishing the amount of eternal verity you may append thereto, and still "get by" with it. But don't attempt to exploit the eternal verities on their own merits. They are not newspaper merits.

The second condition of news is, of course, human interest. *News is any humanly interesting thing, which happens in some particular place, to-day.* Very many subjects of scientific investigation, including some things of educational value as to scientific method, come within this definition. Professor Ritter's investigations of the relation of sea temperatures and rainfall, or of the migration of food fishes, have intense human interest, and if it can be stated that "Professor Ritter discovered, at La Jolla, to-day," or "announcement was made, at La Jolla, by Professor Ritter, to-day," then the time, place and personal factor are added, which make them news. Most of the chemical investigations of the war, at whatever date they can be announced, are intensely interesting news—the synthesis of glycerine from sugar, for instance; the extraction of rubber from desert shrubs, or the development of new and rare metals. The beginning and the end of the kelp industry, and the belated announcement of war by-products, are news—the day they happen or are first given out. The human facts regarding the service of scientific experts to the war are news, when given out. The war has made chemistry respectable, to the popular imagination, just as the discovery years ago, by Professor Walter Dill Scott, that psychology would make money in advertising made psychology respectable. Even astronomy has rendered enough service in this war to make it respectable, if the facts were given out.

Scientific methods seem particularly hard to make news of, but our agricultural scientists have succeeded in doing it. The one thing necessary, to gain the confidence of the practical farmer in the farm adviser, was to remove the illusion that the farm adviser was a book-learned man. When the farmer learned that the farm adviser found out things the same way he did, only more systematically and more exactly, then his knowledge became respectable. By trying practical experiments, in places where they became news; by collating practical results from their application; by putting a sporting interest into pig clubs; by making speeches at farm meetings and get-

ting them into the newspapers (a speech is news, when it is delivered, even if it is about the eternal verities) the farm advisers, as the outposts of agricultural science, have largely solved the problem which the rest of you are facing, of bridging the gap between the scientist and the people.

Medical science, because it is subject to hostile controversy stands particularly in need of publicity, not merely as to its results, but as to its methods. There is a popular delusion that the established facts of medical science are sectarian dogmas, deniable by any one who chooses to propound the contrary dogma. The isolation, therefore, of a new disease germ means nothing to the reader who "does not believe in the germ theory." But if the facts are given out that this germ, isolated from patients sick of the disease, was cultivated for many generations outside of the body, was inoculated in susceptible animals and uniformly produced the disease, and was finally tried on volunteer men and produced the disease in them the knowledge of these facts, which have of course been commonplaces of scientific methodology since Koch, will increase popular confidence in the soundness of medical conclusions, by showing the soundness of the methods by which they are reached. But this sort of publicity is frequently prevented by scientific squeamishness. For instance, army research laboratories, during the recent influenza epidemic, succeeded in isolating the bacillus of Pfeiffer from most of the cases, at least in the early part of the epidemic. I know of at least one such laboratory in which inoculations of fifty volunteer men with pure cultures was followed by clinical influenza in forty-eight, with incidental pneumonia in four or five cases. These results were never given out. But in a certain army hospital, twelve soldiers had their noses sprayed with what was said to be a pure culture of some influenza bacillus, with negative results. This result was given out and got on the wires. The result was that every apostle of medical unorthodoxy in America had a clipping in his pocket, giving this alleged demonstration that influenza is not a germ disease. Nothing will counteract this sort of propaganda, but the truth, promptly, unsqueamishly and if necessarily immodestly proclaimed.

But I have gone on too long on my favorite subject of the daily newspaper end of the subject. Let us consider the still more shocking problem of the Sunday newspaper.

Because of the great amount of advertising in the Sunday newspapers, it becomes necessary to print an excessive amount of reading matter, to float that advertising. The news, as the more buoyant medium, is spread as far as it will go, but it is not enough, and for the rest the newspapers have recourse as a last desperate resort, to literature, science and the arts. Being regarded with contempt, as rubbish in comparison with the news, naturally the standard of selection of these unavoidable evils is far from idealistic. I am not recommending the literature of the "Sunday Sup.," and I share your horror of most of its science. But the point is that there is a page of science there, and where bad science is, surely good science might go. It must, to be sure, be well "yellowed up." If a disease germ can be attached to some well-known man or a geological truth to some recent calamity, so much the better. And it will not do to banish entirely the speculative imagination. May not the rumors of the sea serpent be based on the survival of some monster of a former age? How would the earth look to the inhabitants of Mars, if there are any, and what chest measure would they have to have to breath its thin air, and how high could they jump? Can the creatures of the abyss teach us the mystery of cold light? Can synthetic chemistry feed mankind when the earth becomes too overpopulated for animal and vegetable food? These may be childish questions, but at least it is better to answer them with truth than with falsehood. And if the scientist will bring himself to realize the primary importance of the picturesque and the human interest, as unlocking the key to the "Sunday Sup.," he can then at least do something toward keeping scientific nonsense out of this the most widely circulated of all scientific

publications, and he may do something toward getting scientific truth into it.

May I also add just a word on political science?

It is one of the calamities of democracy that most economic and social problems are first worked out by experts, who embalm their results in books which are interred in university libraries, and are then, long after, worked out by rule of thumb, by practical politicians and business men. One of the supreme problems of our universities is to bridge this gap.

Of the popular scientific magazines, I scarcely need speak. You know them better than I do. But do they need to appeal so nearly exclusively to the mechanical curiosity of boys? Some magazines, like *Good Housekeeping*, are doing excellent work in popularizing dietetic science among women. Is there not some way to penetrate the indurated intellects and the atrophied imaginations of our adult men, also?

I realize that I have added little to your knowledge of any subject, by these desultory remarks. May I hope, however, to have aroused at least a little unscientific curiosity?

Chester H. Rowell

EMIL FISCHER

The news has just reached us that Emil Fischer is no more. Since the fateful August, 1914, Germany has lost her Ehrlich, her Buchner, and her Baeyer; England, her Ramsay, Crookes and Moseley. Deaths occur, wars or no wars; yet Buchner might have lived had not a shell cut short his existence; and young Moseley had barely started along his brilliant career when he, like the promising Rupert Brooke, laid down his life for his beloved England. Ramsay's end, we know, was hastened by manifold war duties. To what extent Fischer was a victim of the war is still unknown to us; but we were told, from time to time, of his violent pan-Germanism, doubtless encouraged by the exalted position he held under the crown. The magnitude of Germany's *débâcle* would have crushed a spirit less proud than *Geheimer-Regierungsrat* Fischer.

What ever opinions we may have regarding Fischer's political affiliations there can be no question of his position in the history of chemistry. His bitterest enemies are the first to pay tribute. He easily takes his place among the greatest organic chemists of our generation.

To appreciate his work a little more we must look into the state of the science when Fischer began his labors.

That animal and vegetable life were largely made up of carbon compounds, that the food we eat could be largely divided into fat, proteins and carbohydrates —all this was known. If, then, a knowledge of the composition of these substances, as truly belonging to organic chemistry as marsh gas or benzene, was vague and wholly unsatisfactory, this was due to the complexity of their make-up. Chevreul and Berthollet had largely cleared the situation in so far as the fats were concerned, but the chemistry of the carbohydrates, and particularly that of the proteins, remained as mysterious as ever. The three foodstuffs were the borderland where chemistry ended and biology began; the lack of a solution of the composition of at least two of these foodstuffs left the finishing touches of the edifice of organic chemistry still undone, and gave a wholly unsatisfactory foundation for the science of physiology.

To the solution of this problem Fischer pledged his life while still a student, and brilliantly did he fulfil his life's task. With an imagination tempered only by a splendid scientific training, an originality of mind which made a lasting impress upon every piece of work with which he was associated, and a rare skill in devising apparatus, he, first by his own labors, and

later, as director-general of an army of aspiring students, gradually unfolded the mysteries that had enshrined the most complex chemical substances known to man. Like all great contributions, his had added not only to our chemical knowledge but has shed a flood of light on cognate sciences, such as botany, zoology and physiology.

Fischer was born in Euskirchen, Rhenish Prussia, on October 9, 1852. His father, Lorenz Fischer, was a successful merchant whose success in business must have made a deep impression upon his son, for Emil, after matriculating the gymnasium in Bonn, joined his father's concern at the age of seventeen.

This enthusiasm for the commercial world, however, was short lived. Within two years he had abandoned all thoughts of high finance, and had inscribed himself as a student at Bonn University. Kekulé, one of Van't Hoff's teachers, was the professor of chemistry, and Engelbach and Zincke were his active assistants. Fischer came in contact with all three.

The ill-omened Franco-German war had barely terminated when the German government decided to found a university at Strassburg. To this place, in the autumn of 1872, Fischer, true to the German student's traditions, came to spend part of his *Wanderjahre*.

By the end of a year Fischer was ready for the next step in the training of a chemist—a course in organic chemistry. This brought him in contact with Adolf von Baeyer, the professor of the subject.

Fischer immediately came under the spell of Baeyer. The professor was rapidly reaching the height of his intellectual output. His amazing mastery of every phase of the subject, the keen criticism to which every piece of work was subjected, the fertility of his ideas, combined with the fatherly care he took of his "children," the students, made Baeyer very popular with his assistants and research workers, not least of all with Fischer.

In July, 1874, Fischer completed an investigation on the coloring matters fluorescein and orcin-phthalein, for which he received his Ph.D. His immediate appointment to an assistantship was evidence that he had already made an impression upon Baeyer, whose faculty for detecting promising material was not the least of his gifts.

In less than a year Fischer, with his discovery of phenylhydrazine, forged to the very front rank of organic chemists. Later this substance in his hands proved the most effective tool in synthesizing the sugars, which are the typical members of the carbohydrate family. To-day the *osazone* test for sugars, a test depending upon the use of this same phenylhydrazine, is among the commonest and the most effective methods used by the chemist, the physiologist, and the clinician for the isolation and detection of the sugars.

Little wonder, then, that when Baeyer in this same year was selected to succeed Liebig, in Munich, he was desirous that young Fischer should accompany him. This, of course, was just what Fischer wanted.

For the next three years Fischer held no official position at the University of Munich. As events proved this was the most fortunate thing that could have happened.

With phenylhydrazine as the starting point, the various derivatives of this parent substance were investigated, and its relationship to the *diazo* compounds was clearly established. The ease with which the phenylhydrazine combines with other substances gave rise to an almost endless series of new compounds. To us of par-

ticular interest is its combination with two important classes of organic compounds known as the *aldehydes* and *ketones*—a discovery which found direct application in the chemistry of the sugars.

At the same time, Fischer, in collaboration with his cousin, Otto Fischer, began an investigation of the rosaniline dyestuffs —the magenta of Perkin—which terminated in the brilliant discovery that these dyes were all derivatives of a base *triphenylmethane*.

Fischer was made *privat-docent* in 1878 and at the end of the year was promoted to the extraordinary professorship and given entire charge of the analytical department in Baeyer's laboratory.

Then began those classical investigations into the active constituents of coffee and tea, caffeine and theobromine, and their relationship to xanthine and guanine—decomposition products obtained from the protein in the nucleus of cells—which ultimately opened up an entirely new chapter in plant and animal chemistry.

In the Easter of 1882 Fischer accepted a call as full professor (*ordinarius*) to Erlangen, and three years later be exchanged this chair for one in Würzburg.

After many weary trials, Fischer managed to synthesize the most important sugars—among them fruit and grape sugar —and also to prepare many new ones artificially. It was in the course of this intricate and laborious work that he had occasion to put Van't Hoff and Le Bel's theory of the asymmetric carbon atom to exhaustive tests, with results which established the theory more firmly than ever.

It was also during these epoch-making experiments on the sugars, when phenylhydrazine found constant application, that Fischer began to suffer with chronic poisoning, due to the inhalation of the vapors of this substance. Its effects he never got rid of, and from then on he was more or less of a semi-invalid. This might perhaps explain why in after years students found him somewhat of a "grouch" and quite unapproachable. The testimony of some of his students at Würzburg seems to bear conclusive witness to the fact that in those days, at least, he was not only an inspiring leader and lecturer, but took a very active interest in his research men.

The appointment to a full professorship made feasible his marriage to the lady he had long courted, *Fräulein* Agnes Gerlach. The two made a striking pair. Both were tall and handsome, with intellect and wit aplenty. Their son has faithfully followed in his father's footsteps.

In 1892 came the crowning event of his career. A. W. Hoffmann, who had been professor at the Royal School of Chemistry in London for some years, and had there taught such men as Crookes and Perkin, and had later been appointed to the chair of chemistry at Berlin University, died, and Fischer was selected to succeed him.

In Berlin Fischer continued his work on the sugars. The fact that many of these bring about fermentation led Fischer to fruitful studies on the possible constitution of ferments and their relationship to the substances they act upon.

Fischer's synthetic work in the sugar series, particularly his studies into the configuration of cane sugar, maltose and lactose received a great impetus from the success which attended his efforts in preparing glucosides—combinations of glucose and one or more other substances—artificially. By the study of emulsin and other enzymes in yeast on such glucosides, Fischer found that the slightest change in the configuration of the glucoside inhibited the action of the enzyme. Zymase, another enzyme in yeast, which is directly responsible for the conversion of glucose into alcohol, behaved

similarly. This led him to the conclusion that a close chemical relationship exists between the enzyme and the substance on which it acts—a view which led to his famous analogy of the lock and key relationship. Just as one key fits one lock, so any one enzyme will act on only a certain type of substance.

In the winter of 1894 Fischer resumed his earlier work on uric acid and caffeine. After three years he succeeded in synthetically producing every constituent of the group, and traced them all to a mother substance to which he gave the name of *purin* (a word suggested by the phrase *purum uricum*).

The chemist, the physiologist and the pathologist can but wonder at such genius. Here are the most complex and the most important class of protein bodies, the so-called nucleoproteins, which, as their name implies, are found in the nucleus of the cell, and which, in the course of their decomposition in the body, give rise to *xanthine, hypoxanthine, adanine, guanine, etc.*—all typical purines. Here are these purines which, in their further travels in the body, come to the liver, where a larger percentage of them are oxidized to uric acid—another member of the purine family. This same uric acid is a never-failing constituent of the urine, and its quantity gives valuable data regarding nucleoprotein metabolism in the body. This becomes of paramount importance in such a disease as gout. The inter-relationship of these complex purines, as well as their relationship to plant analogues, such as caffeine and theobromine, have been as thoroughly probed by Fischer as the composition of water or that of air. He has gone even further. Having found relationships, and having traced the substances to one mother substance, he has succeeded in building them all up from this mother substance—a piece of work which with but one exception, has no equal in synthetic chemistry.

The one exception is Fischer's crowning series of researches on the proteins. No work approaching this had ever been done before.

Fischer was not the first to tackle this problem of problems, but he was the first to give the lead in the right direction.

The crude physical methods of classifying proteins have pointed to the fact that there are some forty to fifty in number. All of these, when hydrolyzed, give a large percentage of the nineteen amino-acids which are common to most proteins; the differences among proteins is most marked in the amount of the various amino-acids which they yield when hydrolyzed,

Due in no small part to the labors of Fischer and his co-workers most of these nineteen amino acids have been synthesized from simpler bodies.

If the hydrolysis of proteins, and the careful investigation of the decomposition products so produced was a difficult task, what are we to say of the reverse process, whereby, by starting with amino-acids, we build up proteins? Yet that is what Fischer did. He succeeded in working out methods by which amino-acids could be chemically joined on to one another in some such way as the links of a chain. He has given the name *polypeptids* to such combinations of amino-acids.

In his most celebrated experiment in the synthesis of proteins, Fischer succeeded in combining eighteen amino-acids—an octadecapeptide—which is the most complicated artificial substance that has ever been produced, and which shows some very striking resemblances to the natural proteins, not the least of which is the way trypsin, the pancreatic enzyme, breaks it up into the amino-acids out of which the artificial protein was built.

The starting materials for this synthesis cost $250, "so that," says Fischer, "it has not yet made its appearance on the dining table!"

These glorious researches were still in full blast in 1902 when Fischer was awarded the Nobel prize in chemistry.

There seems to be some foundation for the fact that the opening up of our Rockefeller Institute in New York City gave German scientists some very unpleasant moments. They were afraid that an institute, devoted entirely to research, and manned by talent second to none, would soon outstrip any university, where of necessity teaching, aside from research, required much attention. This led Ostwald, Nernst and Fischer to start an agitation for the endowment of some similar institute in Germany, with the result that the research institute in Berlin-Dahlem was founded.

Fischer's researches into the carbohydrates, purines and proteins, is of such enormous importance that, at the repeated requests of the scientific public, they were published in book form in three bulky volumes, the first, "*Untersuchungen über Amino-Sauren, Polypeptide und Proteine*" (1899–1906), dealing with the proteins, the second, "*Untersuchungen in der Purin Gruppe*" (1882–1906), with the purines, and the third "*Untersuchungen über Kohlenhydrate und Fermente*" (1884–1908), with the carbohydrates and enzymes. It is certain that in organic chemistry no three volumes of such far-reaching influence have ever before been published.

Fischer's most recent work dealt much with the tannins, substances that play an important part in leather manufacture.

Fischer's work, his influence as teacher and inspirer of men, raised the Berlin Chemical Laboratory to the first position among the chemical laboratories of the world. His fame attracted students from every quarter of the globe, and these flocked in such numbers to him that they soon counted in the hundreds, and special *privat-docenten* had to be appointed to take care of them. It thus came about that many of the men who had gone to Berlin to work under Fischer in reality worked under some of Fischer's *privat-docenten*, and, outside of the lectures, probably did not see Fischer himself more than two or three times during their three or four years in the German capital. At one time or another H. Gideon Wells, that excellent pathologist of Chicago University, T. B. Osborne, of the Connecticut Experiment Station, and the foremost authority on vegetable proteins, and P. A. Levene and W. A. Jacobs, the well-known physiological chemists of the Rockefeller Institute, were his students. Of his many pupils Fischer considered Emil Abderhalden, now the professor of physiology at Halle University, a Swiss by birth, the most gifted.

Fischer's death is an irreparable loss to science. He is so much of our generation that one hesitates to use superlatives, but one is sorely tempted to speak of him as the greatest organic chemist of all times.

Benjamin Harrow
Columbia University

SCIENTIFIC EVENTS

DESTRUCTION OF ELEPHANTS IN CAPE COLONY

A special correspondent of the London *Times* writes that the provincial council of the Province of the Cape of Good Hope has passed a decree authorizing the destruction of the herd of elephants in the Addo Bush Forest Reserve. Unless this Union government take action promptly, this hitherto carefully-preserved remnant of a species that once ranged all over South Africa will be utterly destroyed. The last elephant in Zululand, an old male, was recently killed. The elephants of South-

ern Rhodesia have been exterminated. In the Eastern Transvaal, near Portuguese territory, a few survivors of a small troop occasionally are seen, but they are being attacked from both sides and are on the verge of extinction. It is possible that there may be a few individuals left in the Knysna Forest, Cape Colony, but the game warden is extremely doubtful about this.

The Addo Bush, near Port Elizabeth, until recently was a waterless scrub of little value. In its center an area of approximately 6,000 acres has long been a reserve for the elephants. The land is not fenced off, and farms at first of small value, but now being developed by irrigation works from Sunday's River, surround it. The herd numbers between 100 and 200 individuals, the only surviving examples of a distinct variety, characterized by a strongly arched forehead, enormous ears, roughly square outline, short fore-legs and a very hairy body.

The proposed action is not a case of wanton destruction. The Provincial Council has given long consideration to the matter, and has passed the decree only after careful investigation by a special committee, whose members were fully alive to the zoological calamity that their recommendation involved. The elephants sally out of their reserve in quest of food and water. They break down fences, stampede cattle, destroy crops, and frighten human beings. They assume that the irrigation canals are intended for their benefit and in taking their baths they destroy the banks and dams.

The committee reported that the elephants could be confined only by the erection of a fence 13 miles in length, and a structure sufficiently strong to contain elephants would have cost at least £20,000. It would have been necessary, moreover, to provide a water supply, and it is more than doubtful if the area enclosed would have provided natural food in sufficient quantities.

AN AMERICAN HOSPITAL FOR GREAT BRITAIN

THE *British Medical Journal* reports that plans for the establishment of an American hospital in London are now in so advanced a stage that a meeting of the governing council had been arranged at the house of the Royal Society of Medicine, at which Lord Reading (who has accepted the presidency of the hospital) and the American Ambassador promised to be present. Upon the signing of the armistice last November it was considered that the moment was ripe for bringing the project of an American hospital to the consideration of the medical profession in Great Britain as well as of the American colony in London. The promoters were of opinion that the need of the foundation of such a hospital was obvious, and that the exceptional opportunities of the moment were never likely to recur. The scope which should be given to the hospital was discussed by a Medical Executive Committee, consisting of Sir William Osler, Sir Arbuthnot Lane, Sir Humphry Rolleston, Sir John Bland-Sutton, Mr. J. Y. W. MacAlister, and Mr. Philip Franklin. At the meeting of the American Medical Association, in Atlantic City, in June, Sir Arbuthnot Lane notified officially that the hospital would be established. He pointed out that no more fitting monument could be raised to those who had fallen in the war, and that the hospital was designed to form the headquarters for American medical men who visited Europe for the purpose of post-graduate study. At the meeting the plans of the committees, as described by Sir Arbuthnot Lane, were received with enthusiasm, and he was assured by distinguished members of the profession that the medical men of America were keenly alive to the great value of such an institution in England as a center for study and research. A committee was then formed to ensure the cooperation of American doctors upon a definite footing, and to act in conjunction with the executive committee in London, and, if desirable, to work under the National Research Council at Washington. This American committee consists of Dr. George W. Crile, of Cleveland; Dr. W. J. Mayo and Dr. Charles H. Mayo, of Rochester, Minnesota; Dr. Albert J. Ochsner, of Chicago; Dr. Rudolph Matas, of New Orleans, and Dr.

Franklin Martin, of Chicago. This committee will send a delegate to assist the London Medical Committee here in the detailed organization of the hospital. It has, we are informed, been planned upon the most modern lines, and will be complete in every department of medical and surgical activity; accommodation will be arranged for every class of patient. A research institute, modelled upon the Rockefeller Foundation of New York, will form an integral part of the plan. The consulting staff will bring together distinguished members of the profession in the United States and Great Britain. The visiting staff will be nominated by the executive medical committee. The governing council of the hospital consists of many prominent members of the American colony in London. Mr. Philip Franklin is acting as honorary secretary.

THE COMMITTEE ON FOOD AND NUTRITION OF THE NATIONAL RESEARCH COUNCIL

This committee held an organization meeting at Cornell University Medical College, New York City, on July 11. The following tentative program was presented by Professor Henry P. Armsby and was adopted with but slight modifications:

Regarding the committee as being substantially a coordinating rather than a research body, the following tentative outline of objects and methods is suggested.

OBJECTS

1. To promote scientific research upon the nutrition of men and of animals (especially animals of agricultural importance) and to bring about closer relations between the two fields of work.

2. To promote study of the economic aspects of nutrition—*i. e.*, study of national and international as distinguished from personal nutrition.

4. Pending the possible establishment of a National Institute of Nutrition, to act as an unofficial clearing house for existing research institutions and to promote coordination of both American and foreign research.

4. To promote sane and authoritative extension and propaganda work in the interest of better nutrition.

METHODS

In considering methods, it must be borne in mind that the committee has only moral and not mandatory authority. In all plans, care must be taken to preserve the democracy of science.

1. (*a*) Preparation of a broad program of research in both human and animal nutrition, emphasizing especially gaps in present knowledge with suggestion of problems of more immediate importance.
   (*b*) Maintenance of research fellowships.
   (*c*) Subsidizing of especially important researches.
2. (*a*) The cooperation of statistical agencies would appear necessary.
3. (*a*) Meetings of the committee and of nutrition investigators in general, especially for the sake of maintaining personal touch and considering programs of research.
   (*b*) Correspondence and publications.
   (*c*) Representation of the United States in the International Scientific Commission of Nutrition.
4. (*a*) Cooperation with existing governmental agencies and educational institutions, especially of the land grant colleges.
   (*b*) Cooperation with the American Public Health Association.

Among the questions affecting public welfare which require immediate investigation, the committee considered the following the most important:

(*a*) Practical changes in methods of food production for the purpose of reducing the cost of living without reducing the quality of nutrition.

(*b*) Diet in relation to industrial efficiency.

(*c*) The food requirements of growing children.

It was estimated that thirteen fellows of the National Research Council could profitably be put to work at once upon these problems and various possible sources of funds were discussed.

Miss Isabel Bevier was elected an additional member of the subcommittee on human nutrition and Dr. W. H. Jordan and President Raymond A. Pearson were elected additional members of the sub-committee on animal nutrition.

Information has been received from Dr. Alonzo E. Taylor, who is still in Paris, that "The Inter-Allied Scientific Food Commission closed its existence at Brussels on May 25 with recommendations to the governments

involved to form an Institute for the Study of Nutrition, to be connected with and a part of the League of Nations in precisely the same manner as the League of the Red Cross will stand with reference to sanitation."

SCIENTIFIC NOTES AND NEWS

DR. ERNST HEINRICH HAECKEL, professor of zoology at the University of Jena since 1865, died on August 9 at the age of eighty-five years.

AT a meeting of the Royal Society of London, held on June 26, Dr. Simon Flexner, of the Rockefeller Institute for Medical Research, was elected a fellow.

THE former students of Dr. T. C. Chamberlin, for twenty-seven years head of the department of geology at the University of Chicago, are planning to hold a dinner in his honor on the evening of September 27 in Chicago. Dr. Chamberlin has recently retired with the title of professor emeritus and expects to celebrate his seventy-sixth birthday in September. Further information concerning the dinner may be obtained from Kirtley F. Mather, Granville, Ohio.

OUR attention has been called to the fact that prior to the election of Dr. George E. Hale to be a foreign associate of the Paris Academy of Sciences the distinction had been conferred on five other Americans: Benjamin Franklin (1772), Count Rumford (1803), Louis Agassiz (1872), Simon Newcomb (1895), and Alexander Agassiz (1904).

IN recognition of his fifty years' service as a teacher of physical education, Dr. Dudley A. Sargent, retiring director of the Hemenway Gymnasium, was presented on August 7 with a large loving cup and punch bowl. The gift comes from students in the department of physical education of the Harvard Summer School.

THE Franklin Institute, Philadelphia, acting through its Committee on Science and the Arts, has awarded to Joshua J. Skinner, of the Bureau of Plant Industry of the Department of Agriculture, its Edward Longstreth Medal of Merit for a paper on "Soil Aldehydes," appearing in the five issues of the *Journal* of The Franklin Institute from August to December, 1918. In awarding this medal, the committee reported:

> These papers present the results of scientific study of a new class of deleterious soil constituents, clearly described and effectively illustrated, the whole forming a valuable contribution to the science of agricultural chemistry, and one of marked practical importance.

In 1912 this medal was awarded to Dr. Oswald Schreiner and Dr. E. C. Lathrop, also of the Bureau of Animal Industry.

DR. ASA C. CHANDLER, assistant professor of zoology and physiology at the Oregon Agricultural College, who made a study in the trenches at the European war front of rats and parasites in their relation to transmitting diseases to human beings, is now in California and will return to the college next school year.

DR. D. G. BYERS, of the University of Washington, has been appointed chief of the division of chemistry in the Bureau of Soils, U. S. Department of Agriculture. Mr. W. O. Robinson, of the Chemical Warfare Service, has returned to the bureau.

MR. W. E. PERDEW recently resigned his position as chemical engineer in the Petroleum Division of the Bureau of Mines to enter the employ of the Union Petroleum Company of Philadelphia.

PROFESSOR WILLIAM PETERSON, geologist for the Utah Agricultural Experiment Station and College, has been granted a six-months' leave of absence to make an appraisal of the mining properties of Utah for the State Board of Equalization.

PROFESSOR W. M. COBLEIGH, professor of chemistry in the State College of Agriculture and Mechanical Arts, of the University of Montana, has been appointed state chemist under provisions made in an oil inspection law passed by the Montana legislature. The work of the state chemist will be organized as a part of the required work of the department of chemistry.

PAUL ASHLEY WEST, formerly instructor of chemistry, The Jessup Scott High School, has

accepted the directorship of The Research Laboratories Company of Toledo, and Dr. G. A. Kirchmaier, for twenty-two years city chemist of the city of Toledo and for the State Agricultural Department, has accepted the position of consulting and analytical chemist with this company.

Dr. Norman A. Shepard, assistant professor of chemistry at Yale University, has resigned to accept the position of research chemist with the Firestone Tire and Rubber Co., Akron, Ohio.

The *Journal of Industrial and Engineering Chemistry* reports that a "Fixed Nitrogen Research Laboratory" has been organized in the nitrate division of the Ordnance Department, with headquarters at the American University, in buildings formerly occupied by the Chemical Warfare Service. Lieutenant Colonel A. B. Lamb, of the Chemical Warfare Service, is director; Dr. R. C. Colman, formerly of the Chemical Warfare Service, and Professor W. C. Bray, of the University of California, are associate directors; and Dr. H. A. Curtis, formerly of the nitrate division, Ordnance Department, is executive officer. The work carried on during the war on the fixation of nitrogen in the Department of Agriculture laboratories at Arlington, Virginia, the geophysical laboratory, and elsewhere, will be concentrated at the American University. In the absence of Colonel Lamb in Europe, Dr. Tolman is acting director. At present the staff consists of fifty-five persons.

Dr. W. J. V. Osterhout, professor of botany in Harvard University, will deliver a series of six lectures on the Hitchcock Foundation of the University of California from August 20 to 29 on the general topic, "Fundamental life processes." Dr. Osterhout was assistant professor of botany at the University of California from 1907 to 1909.

A French edition of Professor Vernon Kellogg's "Headquarters Nights," with a special preface by Minister Brand Whitlock, has just been issued by the Paris publishing house of Payot et Cie.

Nature states that Dr. H. R. Mill has retired from the position of director of the British Rainfall Organization and from the editorship of *British Rainfall* and *Symon's Meteorological Magazine,* which he has carried on since 1901. Serious impairment of eyesight consequent on overwork led Dr. Mill to make arrangements for retiring in 1914, when the outbreak of the war caused him to postpone the step; he now finds his health unequal to the strain of adapting the work to post-war conditions.

The *Journal* of the American Medical Association reports that having reached the age limit of seventy-five, Camillo Golgi retires from the chair of general pathology and histology at the University of Pavia, but still retains charge of the institute connected therewith where he has been uninterruptedly at work for almost fifty years. A scholarship has been founded in his honor by his friends and pupils, the scholarship to be given to the orphan of some physician killed during the war. At an imposing ceremony he was presented with a gold medal and souvenir album signed by the citizens of Pavia, with other honors. His discovery of the stain which first revealed the finer structure of the nervous system was made during his service in a small hospital at Abbiategrasso, remote from the centers of learning. The Nobel prize in medicine in 1906 was divided between Golgi and Ramõn y Cajal.

According to a statement recently issued by the Surgeon General of the United States Army, 442 casualties occurred among the medical officers of the American Expeditionary Forces in France from July 1, 1917, to March 13, 1919. Of these 22 died of wounds, 9 of accidents, 101 of disease; 46 were killed and 7 were missing in action; 4 were lost at sea. There were 38 prisoners unwounded, 47 wounded in action (degree undetermined), 93 severely wounded in action, and 72 slightly wounded.

The summer meetings of the American Astronomical Society, American Mathematical Society, and Mathematical Association of America will be held at Ann Arbor, Mich., during the week September 2–6. A joint session of the three organizations is arranged

for the afternoon of September 4, at which the program will include the retiring address of President E. V. Huntington, of the Mathematical Association, report on the international conference of scientists at Brussels, and report by Professor E. W. Brown, of Yale University, on the work of the National Research Council with reference to mathematics and astronomy. Special railroad rates may be available for this meeting if the attendance is sufficiently large.

THE eighth meeting of the technical personnel of the experiment stations, and of the officers of the Department of Agriculture, of the Dutch East Indies, was held in Medan, Deli, Sumatra, April 23–29, 1919. On the first day a session was held at the Deli Proefstation voor Tabak; papers on botany, geology and chemistry were read by E. C. J. Mohr, J. G. J. A. Mass, F. C. van Heurn, A. A. L. Rutgers, S. Tijmstra, and P. E. Keuchenuis. From April 24 to April 28, an excursion was made over the east coast of Sumatra, visiting oil-palm, rubber, tea, coffee and tobacco estates. A trip was also made over the beautiful Toba Lake and the Karo Plateau. The largest rubber estate in the world was among those visited. This is owned by the Hollandsche-Amerikaansche Plantage Maatschappij, a subsidiary of the United States Rubber Co. Here a banquet was given in honor of the visiting scientists. After the return to Medan, another session was held at the Deli Proef-station, at which papers were read by Carl D. La Rue, and Ir. Kalshoven. At the same session an organization was made under the name of "Vereeniging van Proef-station Personneel." The society is intended to bring about closer cooperation between the various public and private experiment stations, and to promote the interests of science and scientific men in the Dutch East Indies.

Nature states that the council of the British Association recently instructed a deputation, consisting of Professor Arthur Keith, Sir Edward Brabrook and Professor A. W. Kirkaldy, to wait upon the Ministry of Pensions in order to urge the utilization of anthropometric and kindred data collected by the disbanded Ministry of National Service. The deputation was received on behalf of the Minister of Pensions by Colonel Arthur L. A. Webb, director-general of Medical Services, Ministry of Pensions, who explained that the medical statistical department of the Ministry of National Service, of which Dr. H. W. Kaye was in charge, and the data collected by that department, had been taken over by the Ministry of Pensions Dr. Kaye had not only to direct the compilation of medical recruiting statistics, but also to organize a special branch to deal with medical data connected with the Ministry of Pensions. It was thus impossible for Dr. Kaye's department to give its undivided attention to the preparation of returns relating to the physique of recruits in the various areas and trades of the country. At the present time all the data relating to Grade IV. men were being examined and compiled. Colonel Webb also explained that Dr. Kaye's department was endeavoring to obtain data for comparison from Canada, New Zealand and the United States. The deputation, before withdrawing, thanked Colonel Webb, and urged the early publication of results, which are now needed by all who are studying problems connected with the present physical condition of the population.

THE *Journal* of the American Medical Association quoting from the report of the New York Milk Commission on the infant mortality rates of the different cities of the United States for the year 1918, states that the infant death rate for New York City was 92 per thousand living births. Although the estimates show that the death rate for the country increased seven points last year, the milk commission believes these rates are remarkably low when all the elements conspiring against the baby are considered. The infant mortality rate of seventy-nine cities with populations under 50,000 was 97.2. The rate for thirty-eight cities of between 50,000 and 100,000 was 113.8, and that for forty-five cities of 100,000 population was 103.5 The average baby death rate for the registration area of the United States is 104. Twenty-two of the cities of 100,000 are above this average, and twenty-

two are below. The rates for a number of the larger cities are reported as follows: Chicago, 104.3; Philadelphia, 126; Boston, 114.9; Baltimore, 147.8; Pittsburgh, 122.5; Buffalo, 121.5; Milwaukee, 108.2; Cincinnati, 104.1; Newark, N. J., 104.7; New Orleans, 123.3; Washington, D. C., 110.9; Jersey City, 118.7; Louisville, Ky., 117.3; Denver, 107.3; Syracuse, N. Y., 117.4; Birmingham, Ala., 133.5; Memphis, Tenn., 145; Scranton, Pa., 144.3; Richmond, Va., 146.3; Fall River, Mass., 161.3; Lowell, Mass., 159.1; Albany, New York, 107.4. Only three cities reported baby death rates below 50. These cities are all of the class below 50,000. Brookline, Mass., has the lowest rate, 35.4; Madison, Wis., is next with 38.1, and Pasadena, Calif., third, with 43.8.

As a result of meetings between the government and representatives of technical and scientific societies, a department of glass technology was opened at Sheffield University. From very small beginnings the department has grown quickly and to-day it is turning out work equal to anything the Germans have done. As most of the work has been of an experimental nature the cost has been heavy. Much has yet to be done, with this object in view, if the industry is to be commercially sound and able to compete in the world's markets. A Glass Research Association is being formed. The government being asked to provide £75,000 over a period of five years and the manufacturers are expected to contribute another £25,000. The Controller of the Glass Ware Department of the Ministry of Munitions has called a meeting of manufacturers to discuss the scheme. Substantial promises have already been received from manufacturers interested and a provisional committee has been appointed. The Association will first turn its attention to problems of machinery and labor-saving devices.

The *American Museum Journal* states that about twenty miles south of the great fossil quarry at Agate, Nebraska, there is a peculiar fossil deposit of somewhat later geological age, which has been called the Snake Creek beds. They consist of a series of small pockets in the sand and gravel beds near the surface, full of fossil teeth and bones, mostly fragments, but with many jaws and complete bones and occasional skulls among them. Three-toed horses are the most numerous; many thousands of teeth have been found, hundreds of jaws, and one fairly complete skeleton. A great number of other animals of the Lower Pliocene are represented in the American Museum collections from the pockets, obtained in 1908 and 1916. During this last summer Mr. Albert Thomson has obtained for the Museum an additional collection which includes a few specimens, the best being fine skulls of the long-legged rhinoceros, *Aphelops,* and the rare rodent, *Mylagaulus.* The collection which he has brought back to the museum will add materially to our knowledge of the mammalian life of the Lower Pliocene.

We learn from the *Journal* of the American Medical Association that four measures appropriating funds and authorizing the United State Public Health Service to investigate and combat a recurrence of the influenza epidemic are now before Congress. Senator Warren G. Harding, of Ohio, has introduced a joint resolution appropriating $5,000,000 for an investigation of influenza and pneumonia. His measure cites that the recent influenza epidemic caused 500,000 deaths in the United States. The Public Health Service and research institutions are authorized to make this investigation. A bill introduced in the House by Congressman Simeon D. Fess, of Ohio, authorizes the Public Health Service and the medical departments of both the Army and the Navy to investigate and combat the disease and appropriates $1,500,000 for this purpose. Congressman William W. Larsen, of Georgia, and Congressman Black, of Texas, have introduced similar bills for making an investigation of influenza and allied subjects. The Larsen and Black measures carry an appropriation of $500,000 each. All four measures charge the United States Public Health Service with carrying out the provisions of the act, although cooperation with the army and navy medical departments is advised.

WE learn from the *Journal* of the American Mathematical Society that the technical staff of the United States Ordnance Department has been authorized to secure the services of five experts in mathematics and dynamics, at salaries ranging from $2,500 to $5,000, to conduct scientific research on ordnance problems, act as advisers on all mathematical and scientific problems, for the ordnance department, and keep up connections between the department and the scientific world.

UNIVERSITY AND EDUCATIONAL NEWS

GEORGE EASTMAN, head of the Eastman Kodak Company, has given the sum of $3,500,000 for the establishment of a school of music in connection with the University of Rochester. The school will aim to aid the development of an appreciation of the highest type of motion pictures as an ally of the highest type of music.

IT is stated in *Nature* that to a private deputation from the Education Committee of the Parliamentary Labor party, which urged upon him the desirability of an inquiry into the organization and financial position of the universities of Oxford and Cambridge, Mr. Fisher has made the announcement that the government has decided to appoint commissions to inquire into the position of the universities of Oxford and Cambridge. At both universities the existing resources have proved inadequate to meet the increased cost of maintenance of the various departments, and a few months ago the authorities of each independently applied to the government for financial aid. In reply to these requests Mr. Fisher, on behalf of the government, stated that such grants out of Parliamentary funds could be sanctioned only on the condition that in due course comprehensive inquiries into the whole resources of the universities and their colleges and the use made of them should be instituted by the government. The Cambridge senate on May 31 authorized the vice-chancellor to inform Mr. Fisher that the university would welcome a comprehensive inquiry into its financial resources, and at Oxford a similar decision was taken by convocation on June 10.

DR. ERNEST SACHS, hitherto associate professor of surgery in the medical school of Washington University, St. Louis, has been appointed professor of clinical neurological surgery in the same institution. This is the first instance in which any medical school has recognized neurological surgery by creating for it a separate department.

DR. L. J. GILLESPIE, of the Bureau of Plant Industry, has been appointed professor of physical chemistry in Syracuse University.

DR. N. A. LANGE, formerly instructor in organic chemistry at the University of Michigan has been appointed assistant professor of organic chemistry at the Case School of Applied Science, Cleveland.

DR. HARRY D. KITSON, instructor in psychology at the University of Chicago, has accepted the position at Indiana University made vacant by Professor E. C. Lindley, who accepted the presidency of the University of Idaho.

DR. CLIFFORD H. FARR has resigned his position in the Bureau of Plant Industry to accept appointment as assistant professor of plant physiology in the University of Iowa.

AT the University of Georgia, Paul Weatherwax, Ph.D. (Indiana), has been appointed associate professor of botany with special reference to physiology and genetics. Joseph Krafka, Jr., Ph.D. (Illinois), has been appointed associate professor of zoology, and John Moore Reade, Ph.D., professor of botany, has been made director of the biological laboratories.

APPOINTMENTS for next year at the college of arts and sciences, University of Buffalo, include the following: Daniel B. Leary, formerly head of department of education at Tulane University, to be professor of psychology and instructor in Russian; Edward J. Moore, associate professor of physics at Oberlin College, to be professor of physics, and Albert R. Shadle, assistant professor of zoology at Cornell, to be assistant professor of biology.

PROFESSOR A. FINDLAY, professor of chemistry, University College of Wales, Aberystwyth,

has been appointed to the chair of chemistry in the University of Aberdeen in succession to Professor Frederick Soddy.

Sir J. J. Thomson, master of Trinity College, Cambridge, who recently resigned the Cavendish professorship of experimental physics, has been elected into the newly established professorship of physics. This professorship is without stipend, and will terminate with the tenure of office of the first professor unless the university determines otherwise.

DISCUSSION AND CORRESPONDENCE

FIRE-WALKING IN JAPAN

During my four years' residence in Japan I had several opportunities of witnessing the spectacular religious or quasi-religious ceremony periodically observed at the Ontake Temple, Tokyo, in the course of which the officiating priests walk barefoot over a bed of live charcoal, throw boiling water over themselves and climb a ladder of sharp swords set edge upward. All these pretended miracles, however, are susceptible of scientific explanation, and it is only with regard to the first-mentioned—the fire-walking—that I venture to ask the privilege of making a brief statement in Science.

To the great mass of the spectators in the temple enclosure, who do not usually include more than the merest sprinkling of the more intelligent and better educated classes of the Japanese people, the supposed miracles are the clearest demonstration of the supernatural power of the priests, who would have it believed that it is solely to their incantations that they owe their protection from injury. But it is not necessary to be a very close observer of their movements to perceive that the priests are not content with their perambulations, genuflexions and prayers, but are careful to rub their bare feet with salt, *ostensibly for purificatory purposes,* before walking over the fire. This fact brought to my recollection the occasion, forty years ago or more, when Tyndall astonished a distinguished audience at the Royal Institution by plunging his bare arm into molten metal, the then Prince of Wales, afterward King Edward VII., who was present, being prevented from following Tyndall's example only by the determined opposition of his wife.

So sure did I feel of the efficacy of the salt as a protective agent that on my second visit to the temple I determined to follow the priests in their apparently hazardous adventure, and so after rubbing my feet well in the pile of salt, I walked rapidly over the bed of glowing coal, some eighteen feet long. My confidence was not misplaced. In my feet I felt only a sensation of gentle warmth, but my ankles, to which no salt was applied, were scorched.

After a careful examination of such of Tyndall's works as I had access to at the Yokohama Club, without finding any reference to the demonstration at the Royal Institution, I wrote to Sir William Crookes, who not long before had mentioned to me his association with Tyndall in some of the experiments that preceded the delivery of the latter's famous "Lectures on Light." In due course I received Sir William's reply, in which after reference to certain matters of no special interest in this connection, he said:

> I do not know of any published account of Tyndall's putting his bare arm into molten metal, but I can well believe it, as I myself have plunged my hand into molten, almost red-hot, lead. I was in a profuse perspiration at the time, and, immediately before, I dipped my hand into strong ammonia, to increase the spheroidal effect. I do not think the extra precaution was of much use, but I did not like to take a risk when looking at the cauldron of hot metal.

To physicists there is nothing new in all this, but not every scientific man is a physicist, or hypnotism would not have been suggested to me, as it has been, as the secret of the remarkable immunity I experienced.

John Hyde

Washington, D. C.

MARCHING IN STEP

To the Editor of Science: In regard to Walter Moore Coleman's note in the April 18 number of Science concerning variations in phase in the step of a column of soldiers it

would seem hardly necessary to attribute the perfect marching in the absence of sound signals to any mutual subconscious force passing betwen the men. Would it not be reasonable to infer that in this case the rhythm is sight-transferred? To be sure, in a long straight column any particular squad would not be able to see far down the line, but in getting the time of the step from those somewhat in advance of them there would seem to be as much likelihood of the slight error having either sign, so that there would be no accumulation in error back through the column, as occurs in the case of establishing the rhythm by means of sound signals at the head of the column. That there is, in the absence of sound signals, a sway and swing absent at other times, may be solely a result of perfect rhythm, rather than a result of any difference in the marching of any one man. It is conceivable that in a column of men every man would be marching with rhythmic step, and with dash and enthusiasm, and yet there would be no satisfactory swing and sway to the column if the men were in slightest amount out of step. Synchronize their movements, and the result becomes immediately rhythmic and inspiring, although each man may be taking the same steps in exactly the same way.

That a marching column accepts audible signals in preference to visual signals in case both exist is, I should suppose, a matter of common knowledge. The writer had occasion to drill on the grass-covered Ellipse at Washington many mornings last summer before the heavy dew had gone. The dominant note caused by marching was not that resulting from the planting of the foot, but rather that from the movement through the heavy wet grass—a sound exactly out of phase with the former which ordinarily, in a small body of men, gives the sound signal for the rhythm. The strenuous West-Pointer who was conducting the drill never seemed to realize why he could not keep the men in step at such times. There was a continual wave of changing of step passing back through the column, in an everlasting but hopeless endeavor to make the step coincide with a signal automatically and inescapably out of phase with it.

WARREN WEAVER
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SCIENTIFIC BOOKS

The Elementary Nervous System. By G. H. PARKER. Philadelphia, J. B. Lippincott Co. 1919. Pp. 227, figs. 53.

With characteristic lucidity, Dr. Parker has written the second of the Monographs on Experimental Biology of which Dr. Loeb's "Forced Movements, Tropisms and Animal Conduct" is the first. Limited by the plans already outlined for subsequent volumes of the series to subject matter "drawn almost entirely from the three simpler phyla of the multicellular animals, the sponges, cœlenterates and the ctenophores," this book is nevertheless an illuminating introduction to the more fundamental problems of nervous systems in general. Anatomy and histology are not neglected. The author, however, has attacked the subject frankly as a physiologist, by the method of quantitative experimental analysis that in recent years has been revealing a more and more intimate kinship between biology and the maturer sciences of physics and chemistry. The bibliography at the end of the volume contains one hundred and sixty-six titles, and the author has been exceptionally careful, by frequent references throughout the text, to acknowledge his appreciation of the work of others. Yet, owing to the comprehensiveness of his own researches, he has been able in the development of his theme to review many of his own experiments. In this way, though these reviews are necessarily brief and untechnical, he makes of the reader a co-investigator who shares with him his own keen interest in the problem, his rare skill in devising experiments that are masterfully direct and simple, and who feels the confidence in the results that clear-cut workmanship inevitably inspires.

In an introductory chapter the neuromuscular mechanisms of the higher animals are analyzed into receptors (sense organs), ad-

justors (central nervous organs) and effectors (muscles or other organs that enable the animal to react on the environment). Of these, effectors alone are found in sponges. "They mark the beginnings of the neuromuscular mechanism in that they possess the original and most ancient of its constituents, muscle, around which the remainder of the system is supposed subsequently to have been evolved."

Two chapters are devoted to the sponges, a third to independent effectors in the higher animals, and a fourth to a sluggish type of non-nervous transmission (*neuroid*) that is exhibited by sponges, ctenophores and probably by the ordinary tissues of animals. These four chapters constitute the first of three sections concerned respectively with effector systems, receptor-effector systems, and central nervous organs.

Section two, comprising eight chapters, deals with the neuro-muscular structure of, and nervous transmission in, sea anemones, jellyfishes and hydroids; the nerve net, of which their nervous systems are in large part representative, and which reappears also in the higher animals, *e. g.*, in connection with the musculature of blood vessels and intestine; the diffuse transmission which characterizes the nerve net; and its relation to the appropriation of food and other complex responses.

The single chapter in section three discusses by way of conclusion the relations of the elementary nervous system to the central nervous system of the more complex animals, especially the evolution of that novel element in the system, the central organ or adjustor, which arises in the region between receptor and effector and out of that material which in the elementary system constitutes the nerve net.

General readers as well as special students of science may congratulate themselves on the publication of another book in the growing list by American authors that is making accessible to them in untechnical and attractive form the latest episodes in scientific progress, each with all the authority of a master in his chosen field.

Harry Beal Torrey

NOTES ON METEOROLOGY AND CLIMATOLOGY

METEOROLOGY AS A SUBJECT FOR STUDY

The great importance of weather in military operations[2] early made current European weather information a matter of military secrecy, and put a premium on meteorologists. The U. S. Signal Corps met the demand by training about 500 scientific and technical men in meteorology,[3] and the Naval Aviation Service trained about another 100.[4] Meteorology was also introduced in some institutions as part of the prescribed work of the S.A.T.C.,[5] but most of them had planned this work for the second or third term, and so failed to give it.

Thus at the end of the war, in spite of the stimulation, the amount of meteorological instruction given in the United States had changed but little from its pre-war status: in fact, the loss of instructors eliminated meteorology from the list of courses given at a number of institutions. A recent survey of the extent of instruction in meteorology in the colleges and universities of the United States, revealed only 70 (less than a sixth of the number reporting) in which any course in meteorology or climatology were given; though perhaps an additional third of the institutions of higher learning in the country touch on meteorology in more general courses.[6]

Nevertheless, the present demand for meteorological information, particularly for special aeronautical forecasts, is much greater than ever before; and the demand for more detailed forecasts and for longer range ones has become more insistent. Our institutions of higher learning are already beginning to appreciate

[2] See R. DeC. Ward's articles on the influence of weather on military operations: Bibliography in *Monthly Weather Review*, February, 1919, Vol. 47, pp. 84–85.

[3] See *Monthly Weather Review*, December, 1918, Vol. 46, pp. 560–562, and April, 1919, Vol. 47, pp. 210–225.

[4] *Ibid.*, April, 1919, Vol. 47, pp. 225–230.

[5] See the text-book written for this: "Introductory Meteorology," New Haven, 1918, 149 pp.

[6] For further details see *Monthly Weather Review*, March, 1919, Vol. 47, pp. 169–170.

the situation, and a number are planning new or extended courses. In aid of this encouraging tendency and to meet the demands for such information, the Weather Bureau has published a group of articles on "Meteorology as a subject for study." The titles and brief discussions of the contents of these articles follow:

In discussing, "How meteorological instruction may be furthered," Professor R. DeC. Ward of Harvard shows that the pressure of the students' desire for increased facilities for instruction in meteorology, and the enthusiasm of the instructor will probably be most effective in promoting meteorological training at each institution. The second paper is a rather detailed discussion of, "Collegiate instruction in meteorology," by C. F. Brooks, treating particularly of the methods used in the large classes at the Signal Corps school of meteorology at College Station, Texas. In the third article, Dr. O. L. Fassig has discussed the purpose, organization and results of this school. Following this, a group of the most important new meteorological books have been reviewed to aid the student or teacher in selecting such general publications as will be of most immediate use. Professor W. J. Humphreys' "Some recent contributions to the physics of the air," is an abbreviated edition of his vice-presidential address at the Baltimore meeting of the A.A.A.S.[7] It is introduced with the other papers here to indicate to some extent the present-day trend of meteorology.[8] Finally, to direct research to some of the most important problems now confronting meteorologists, a list of fifty subjects for research in meteorology have been compiled by the scientific staff of the central office of the Weather Bureau.

This group of papers, which was published in the December, 1918, *Monthly Weather Review* has been reprinted, and copies have been sent to several hundred colleges and universities. A limited number of other copies may be obtained on application to the chief of the Weather Bureau.

[7] Published in full in SCIENCE, February 14 and 21, 1919, pp. 155–163, 182–188.

[8] Annual reviews of the progress of meteorology and climatology in the United States are published in the "American Year Book."

THE MILD WINTER OF 1918–1919

In the eastern United States, and over most of the Missouri Valley the past winter was so extraordinarily open in contrast to the winter of 1917–1918, that a Detroit newspaper was led to say we had both winters together in that cold one. Except in the south, the mean temperatures of last December and January were generally 15°F. higher than during the same period a year before. The snowfall was practically negligible as compared with the great accumulations of the previous "old-fashioned" winter. The accompanying table shows some of the marked contrasts in the weather at representative cities. Perhaps the most extreme reversal is shown by Cincinnati weather. There the mean temperature of December and January, 1917–1918, was 19.3° F., while that for December and January, 1918–1919, was 38.5° F., 19.2° F. higher. The snowfall in the two cold months was 36.5 in., but in December and January, last winter, only 1.2 in. Considering together the daily temperatures and snow on the ground, it seems evident that the heavy snow-cover of the cold months made them still colder than they otherwise would have been.[9]

The warm weather and lack of snowfall was a great economic advantage to the country, for transportation was practically unhindered: in striking contrast to the conditions a year earlier. The snowfall in New York City, 0.4 inch in December, 0.3 in January and 0.7 in February was so slight as not to require any expenditure for snow-removal—truly an extraordinary occurrence.[10]

[9] For detailed discussions of the meteorological conditions of the cold winter, see *The Geographical Review*, May, 1918, Vol. 5, pp. 405–414; SCIENCE, 1918, Vol. 47, pp. 565–566, and particularly the article by P. C. Day, on "The Cold Winter of 1917–18," in the *Monthly Weather Review*, December, 1918, Vol. 46, pp. 570–580, 4 figs., 24 charts.

[10] See article in *New York Times*, April 6, 1919, pt. 2, p. 2.

WINTERS OF 1917–1918 AND 1918–1919 COMPARED

	December						January						February					
	Mean Temp. °F.		Departure from Normal		Snowfall (Inches)		Mean Temp. °F.		Departure from Normal		Snowfall (Inches)		Mean Temp. °F.		Departure from Normal		Snowfall (Inches)	
	1917	1918	1917	1918	1917	1918	1918	1919	1918	1919	1918	1919	1918	1919	1918	1919	1918	1919
Boston	23.7	34.7	− 7.9	+3.1	7.0	8.4	21.0	33.2	− 6.0	+ 6.2	13.8	4.1	26.9	32.6	−1.1	+4.6	5.7	6.2
New York	25.0	39.0	− 9.4	+4.6	11.7	0.4	21.6	35.2	− 8.6	+ 5.0	13.6	0.3	29.6	34.7	−1.1	+4.0	3.5	0.7
Washington	27.9	41.6	− 8.2	+5.5	6.8	T.	23.7	38.1	− 9.2	+ 5.2	22.6	0.5	36.8	37.2	+2.3	+2.7	1.5	2.8
Atlanta	36.2	48.2	− 8.4	+3.6	4.9	T.	34.8	43.8	− 7.4	+ 1.6	2.9	0.3	50.8	44.4	+5.6	−0.8	0.0	0.1
Cincinnati	22.3	41.8	−12.1	+7.4	16.3	1.0	16.3	35.2	−14.0	+ 4.9	20.2	0.2	34.5	34.4	+2.1	+2.0	T.	0.4
Chicago	22.4	37.7	− 6.9	+8.4	9.0	8.6	13.3	31.0	−10.4	+ 7.3	42.5	2.0	27.2	30.5	+1.8	+5.1	8.4	6.6
St. Paul	10.1	28.7	− 9.2	+9.4	7.1	6.7	3.7	21.8	− 7.9	+10.2	8.1	6.2	17.4	17.0	+2.4	+2.0	5.0	14.8
St. Louis	26.8	43.0	− 8.7	+7.5	7.5	0.5	18.8	37.8	−12.2	+ 6.8	11.7	0.7	35.6	36.7	+2.1	+3.2	0.2	3.1
Kansas City	23.4	39.4	− 8.1	+7.9	5.3	16.4	17.4	34.4	− 8.8	+ 8.2	10.3	1.0	34.0	34.2	+4.1	+4.3	0.1	13.1
Helena	24.2	28.5	− 0.6	+3.7	31.2	0.6	21.0	32.4	+ 1.0	+12.4	13.4	1.4	23.7	20.4	+1.5	−1.8	5.2	12.5
Boise	43.2	29.6	+11.0	−2.6	T.	2.2	34.4	32.8	+ 5.1	+ 3.5	4.9	0.4	36.0	35.8	+2.2	+2.0	3.2	6.3
Santa Fe	38.2	27.0	+ 7.9	−3.3	0.7	14.4	26.2	24.4	− 2.3	− 4.1	22.7	1.7	35.8	27.2	+3.8	−4.8	1.7	7.6

The region west of the Rockies, which was so warm in the winter of 1917–1918, was generally unusually cold in December, 1918, and in much of Utah, northern Arizona and New Mexico, where the depth of snow was great, in January, and much of February, 1919, as well. Throughout the rest of the region, the past winter was not very unusual.

Charles F. Brooks

Washington, D. C.

SPECIAL ARTICLES

A POSSIBLE CASE OF INSTINCTIVE BEHAVIOR IN THE WHITE RAT

Yerkes and Bloomfield[1] demonstrated that kittens instinctively kill mice but barely implied the instinctive behavior of the mice used. Berry[2] states that mice do not show any fear of cats. The following single observation seems to suggest that white rats do instinctively fear cats. An entirely accidental circumstance furnished a situation in which a young cat came into the presence of several cages of white rats. Although the cages were some feet above the cat, its behavior was quite comparable to that described by Yerkes and Bloomfield. In spite of the intensity of the olfactory stimulus in the room, the reaction of the cat did not take place until the visual stimulus was presented.[3] A periodic and almost spasmodic humping of the back and bristling hair, but entire lack of vocal sounds, were the prominent features. Several minutes produced no change in the situation save that the cat, although making no effort at all to reach the cages, became a little restless. When, however, the cat was placed upon a cage containing five white rats (female) about six months old, their behavior was very definite and specific. The cat responded to the new situation—being high in the air with unsafe footing—by paying no attention to the rats but rather evidencing some fear. The rats retreated to the rear of the cage uttering peculiar whines, and showing other evidences of fear. The cat was then removed and an effort made to feed the rats. A specific vocal sound made by the experimenter has always been sufficient to call the rats to the front of the cage where they are given small bits of cheese. This stimulus has been so grafted on to the feeding reactions that it invariably awakens the rats immediately from sleep, or calls the female from a litter, and, subsequent to the incident described, has repeatedly become prepotent over states of fear produced in other ways. Although over thirty-six hours

[1] "Do Kittens Instinctively Kill Mice?" *Psychol. Bull.*, 1910, 7, pp. 253–263.

[2] Berry, C. S., "An Experimental Study of Imitation in Cats," *J. of Comp. Neurol. and Psychol.*, 1908, 18, pp. 1–25. (Quoted by Yerkes and Bloomfield.)

[3] See Yerkes, *et al.*, *op. cit.*, p. 262.

had elapsed since the last feeding time, it was only by continuous and patient effort that the rats were induced to come forward and take bits of cheese offered. Instead of jumping to some corner to enjoy the morsel undisturbed, however, they huddled together in one place, intermittently whining. An hour later they had eaten their cheese but had not moved from the corner and one was still whining.

A simple test was made in the following manner. The cat was handled and petted a few moments and then an attempt was made to secure a male rat from a near-by cage. The rats are handled so frequently that they ordinarily climb over the hand and lightly bite here and there in search of food. On this occasion, however, the behavior was exactly comparable to that found with the females. In the first case the response might have been to the situation—unfamiliar olfactory and auditory stimuli; and in the second to the situation—unfamiliar odor.

The rats here observed represent ten generations of inbreeding. The writer is positive that during the time he has worked with them no cat has been in the room or near the room. Some such odors may have been carried in the clothing of experimenters, however, but this on close examination seems unlikely. At no time or under any other circumstances has he observed such a specific and definite reaction to a situation as here illustrated. A few hours later the behavior of all the rats was experimentally normal in every way. This observation has suggested the desirability of pursuing a definite experimental method in the problem. An effort will be made to control all the variable factors attending a chance observation and to make some definite statement as to the specific original behavior in this particular situation. It may be that a similar reaction can be evoked by a distinctively strange stimulus. That is, the behavior here illustrated may not be specifically related to the situation —certain unfamiliar qualities of olfactory and auditory stimuli. Any other new stimulus may arouse such reactions; the necessary component of the total perception being just the unfamiliarity or strangeness and not the specific feline odor. It will be quite possible to take a litter of young and provide appropriate stimuli, the responses to which can be scrupulously noted. Variations in age and sex, variations in the situations provided, variations in feeding periods, etc., and a comparative study of the behavior of the wild Norway rat under similar conditions, should throw some light on this particular form of original behavior.

COLEMAN R. GRIFFITH
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THE AGRICULTURAL LIBRARIES SECTION OF THE AMERICAN LIBRARY ASSOCIATION

A MEETING of the Agricultural Libraries Section of the American Library Association was held at Asbury Park, N. J., June 26, 1919. About forty persons were present, including representatives from the Agricultural College libraries of Indiana, Iowa, Kansas, Massachusetts, Missouri, Montana, New Jersey, North Dakota, Vermont and West Virginia and thirteen from the U. S. Department of Agriculture.

Miss Dixon sketched the accomplishments of the Agricultural Libraries Section since its first meeting at Mackinac in 1910, among the most notable which was the bringing about of the publication of the Agricultural Index by the H. W. Wilson Company.

Mr. Milton J. Ferguson, librarian of the California State Library, in a paper entitled "Getting Books to the Farmer in California," described the county library system, the latest development in the state system, which includes all library activities, municipal, state and others, and which shows the energy, foresight and cooperative spirit, which the state of California exhibits in so many fields.

The paper by Miss Marjorie F. Warner, bibliographical assistant, Bureau of Plant Industry, U. S. Department of Agriculture, on "Bibliographical Opportunities in Horticulture," discussed the need of research in connection with the history of cultivated plants and of horticulture; giving illustrations from work which has been done, specifying certain undertakings which should appeal to agricultural librarians, and concluding with a plea for more scholarly research in bibliography both as an individual asset and as adding to the reputation of our libraries.

On conclusion of the paper a gentleman proving to be Dr. J. W. Harshberger, of the University of Pennsylvania, introduced himself as a stranger attracted to the meeting by its program. He congratulated Miss Warner on her paper, and supplemented it by a brief acount of interesting discoveries he had recently made by roundabout methods in seeking information requested by Dr. Sargent, of the Arnold Arboretum, in regard to the Pierce brothers and their nurseries near Kennett Square, Pa., and also alluded to similar methods pursued in regard to William Young, Jr., whose rare "Catalogue des arbres, etc., d'Amérique" (Paris, 1783), has recently been reproduced in facsimile by Rhoads. Mr. Ferguson's and Miss Warner's papers will be published in the *Proceedings* of the Conference of the American Library Association and in the *Library Journal*.

Mr. Charles R. Green, librarian, Massachusetts Agricultural College, presented for discussion the subject of "A Union Checklist of Agricultural Periodicals." He dwelt on the desirability of a list which should make more readily available the present periodical resources of the agricultural libraries of the country, encouraging interlibrary loans and lessening the unnecessary purchase of little used material, and suggested the possible scope of the list, warning against yielding to the temptation to plan an over large project which it would not be possible to carry out. Should such a list include only periodicals on agriculture and its practically related subjects, such as horticulture and animal husbandry, or should it include also those on its related sciences, such as bacteriology, chemistry, botany, entomology, etc.? Or would it be best to issue no nationwide check list, but for agricultural librarians to make an effort to have material of interest to them, included in the various regional periodical union check lists which are in preparation or contemplation?

Miss L. K. Wilkins, chief of the Periodical Division, U. S. Department of Agriculture Library, led the discussion by describing the list of agricultural periodicals of the United States and Canada, compiled as a personal undertaking by Mr. S. C. Stuntz, formerly of the Library of Congress, later of the Office of Foreign Seed and Plant Introduction of the Bureau of Plant Industry. The list which is very comprehensive and in manuscript form, was purchased by the library of the U. S. Department of Agriculture after Mr. Stuntz's death in 1918. Miss Wilkins suggested that this list be used as a basis for the proposed union check list of agricultural periodicals, omitting the historical notes, and biographical sketches of editors.

Mr. H. O. Severance, librarian of the University of Missouri, said he would like to have the list cover periodicals on all sciences allied to agriculture, but the general opinion seemed to be that it should cover only those on agriculture and the branches of agriculture such as animal husbandry, dairying and horticulture.

Mr. H. W. Wilson, president of the H. W. Wilson Company, described the methods being employed in making up the union check list of periodicals of the central states, and Dr. C. W. Andrews, librarian of the John Crerar Library, stated that they would waive exclusive use of the slugs, and would gladly give those for agricultural periodicals to this section, if an agricultural check list were undertaken.

After further discussion, a motion was made to ascertain whether the section thought it desirable to undertake the preparation of such a list, on the cooperative plan. The motion was carried unanimously. Mr. Severance then moved that the chair appoint a committee of three with power to act, and to decide upon methods of compiling and publishing a union check list to agricultural periodicals in libraries in the United States. It was understood that the committee was to make the final decision as to its scope. The following committee was appointed by the chair: Mr. Charles R. Green, chairman, Mr. H. O. Severance and Miss Lydia K. Wilkins.

The question of a union check list of agricultural periodicals is one of great importance to all scientists interested in agriculture. If there are any who have any suggestions to make on the subject, the committee would gladly receive them.

Eunice R. Oberly
Chairman

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